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Students' Learning Difficulties in Mathematics: How Do Teachers Diagnose and How Do Teachers Solve Them?

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Abstract

This study aims to find out how teachers diagnose to determine students' learning difficulties, especially in Mathematics in Elementary Schools. There are four aspects discussed in this study, including the teachers' perception of students' learning difficulties, teachers' practice in connection with diagnosing students' learning difficulties, teachers' actions in response to the results of the diagnosis, parties involved regarding students' learning difficulties. The research method used was descriptive qualitative with 13 teachers as the subject selected by purposive sampling. The data were obtained through interviews with classroom teachers, both from private and public schools, especially in North Borneo. The findings in this study show that the teachers use various ways to diagnose and overcome students' learning difficulties. There are 3 ways that teachers do to diagnose learning difficulties in Mathematics, including tests, observations and interviews. While the ways to overcome them are to do remedial, provide tutoring individually, provide additional hours for students who have learning difficulties in Mathematics and involve students in learning. The method used has been effective, proofed by changes in students' understanding and improvement in students' learning outcomes. This study offers elementary school teachers ways that can be carried out to diagnose and overcome students' learning difficulties in Mathematics.

Keywords: Diagnose, Learning Difficulties, Mathematics, Teacher's Perceptions

Abstrak

Penelitian ini bertujuan untuk mengetahui bagaimana cara diagnosis guru untuk mengetahui kesulitan belajar siswa khususnya pada mata pelajaran Matematika di Sekolah Dasar (SD). Ada empat aspek yang dibahas pada penelitian ini yaitu persepsi guru tentang kesulitan belajar siswa, praktek guru sehubungan dengan mendiagnosis kesulitan belajar siswa, tindakan guru sebagai respon terhadap hasil diagnosis, pihak yang terlibat tentang kesulitan belajar siswa. Metode penelitian yang digunakan adalah deskriptif kualitatif dengan subjek sebanyak 13 orang guru yang dipilih secara *purposive sampling*. Data diperoleh melalui wawancara bersama guru kelas baik sekolah swasta maupun sekolah negeri khususnya di Kalimantan Utara. Temuan dalam penelitian ini adalah guru menggunakan berbagai cara untuk mendiagnosis dan mengatasi kesulitan belajar siswa. Ada 3 cara yang dilakukan guru untuk mendiagnosis kesulitan belajar Matematika yaitu tes, observasi dan wawancara. Sedangkan cara mengatasinya yaitu melalkukan perbaikan/remedial, memberikan bimbingan secara individu, memberikan jam pelajaran tambahan untuk siswa yang mengalami kesulitan belajar Matematika, dan melibatkan siswa dalam pembelajaran. Cara yang digunakan telah efektif yang dibuktikan dengan perubahan pemahaman siswa dan peningkatan hasil belajar siswa. Penelitian ini menawarkan kepada guru Sekolah Dasar cara-cara yang dapat dilakukan untuk mendiagnosis dan mengatasi kesulitan belajar Matematika siswa.

Kata kunci: Diagnosis, Kesulitan Belajar, Matematika, Persepsi Guru

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INTRODUCTION

Mathematics is one of the compulsory subjects that must be studied by all levels of education, starting from the elementary level to the high school level (Hasanah, 2016; Mufarizuddin, 2018). In fact, many studies show that Mathematics is one of the subjects that receives the most negative

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responses because it is difficult and boring for students (Mohd, Rahaimah, & Masran, 2019; Salihu & Räsänen, 2018; Tall & Razali, 1993; van Steenbrugge, Valcke, & Desoete, 2010; Wijaya, Retnawati, Setyaningrum, Aoyama, & Sugiman, 2019). This is a challenge for teachers to overcome learning and teaching in Mathematics, both inadequate facilities and low students' achievement in Mathematics. This problem has even become a national problem in many countries (Gersten, Jordan, & Flojo, 2005).

Finding the roots of students' failure in learning Mathematics can be found in the first grade of elementary school when Mathematics as a subject begins to be taught formally (Salihu & Räsänen, 2018). Thus, it is important for first-grade students in elementary schools to have basic mathematical insights, both in the Mathematics curriculum and in teaching or pedagogical approaches. Furthermore, Salihu & Räsänen (2018) revealed that the failure to learn a mathematical foundation, such as basic Mathematics, can put students at potential risks for education later and when involved in the community. Therefore, it is important for the teachers to assess students' mathematical skills to prevent this and support further students' development. Success or failure in Mathematics is often defined by standardized achievement test results. However, these tests apparently do not provide information regarding mental processes that might contribute to students' achievement (Ostad, 2008). Thereby, an effective way or strategy is necessary to obtain information on students' learning difficulties and how to overcome them.

Van Steenbrugge et al. (2010) stated that particular mathematical topics seem more difficult than others and some curriculum topics have difficulty in all classes in elementary school. Besides, Mathematics is one of the subjects required by various other scientific disciplines (Hasanah, 2016). Students who understand a mathematical concept will also tend to understand other concepts and they are able to learn to represent and generalize simple mathematical concepts (Mulligan, 2011). Difficulties in Mathematics experienced by individuals even to adulthood, have a negative impact on decision making by individuals in everyday life (Salihu & Räsänen, 2018). Thus, the process of diagnosing and analyzing students' learning difficulties is important, especially those related to the basic concepts of Mathematics (Ardi et al., 2019; Lai, Zhu, Chen, & Li, 2015)

Learning difficulties in Mathematics in students must be quickly recognized and treated as early as possible (Hasanah, 2016; Salihu & Räsänen, 2018; Yeni, 2015) because in Mathematics, every new learning skill is built on previous learning and is related to one another (Karibasappa, Nishanimut, & Padakannaya, 2008). Therefore, if students have difficulty in one of the materials, it will be difficult for them to understand the next material. This will ultimately affect the ability of students to learn and understand the material. Moreover, elementary school students according to Jean Piaget are in the Concrete Operational stage (7-12 years old), in which at this stage, students will be easier to receive information if presented using concrete objects and still have difficulties with something abstract (Santrock, 2011). On the other hand, Mathematics is an abstract subject. Because of its abstractness, many students find it difficult to understand mathematical material so that teachers are expected to be

able to convey mathematical material well and following the characteristics of elementary school students.

A number of studies have proofed that many students have learning difficulties in Mathematics. A study by Prasetyawan (2016) revealed that the difficulties experienced by students in learning Mathematics are the difficulty in understanding explanations and the intentions of the questions, the difficulty in understanding material and symbols in Mathematics and the difficulty in carrying out calculations. The methods used by the teacher to overcome this are that they need to provide motivation to students, use varied methods and provide tutoring to students. However, it is not explained in detail how the process of overcoming these problems. The results of this study are still very simple so there is a need for in-depth studies related to students' learning difficulties in Mathematics. In this study, it will be explained more closely the difficulties experienced by students and how to overcome the difficulties of learning Mathematics.

A study by Mufarizuddin (2018) indicated that based on the results of the final analysis test, the difficulty of students in skills is 50% which is included in the moderate category, difficulty in understanding the concept is 23.3% which is included in the poor category and the difficulty in solving problems is 20% which is included in the poor category. This study focuses on the difficulties experienced by students and the factors that cause students to experience learning difficulties in Mathematics. Therefore, further research is needed related to effective ways to overcome the problems of students' learning difficulties in Mathematics. This study will discuss more deeply how to overcome the learning difficulties in Mathematics conducted by the teacher.

Widyasari, Meter, & Negara (2015) also argued that students experience difficulties in Mathematics material. The results showed that 61.29% of students had difficulty mastering mathematical skills and 54.69% of students had difficulty solving problems in Mathematics. This study is more focused on students only, thus it required other information related to students' learning difficulties, such as the teachers' method in dealing with it and the availability of existing facilities. The present study will explain more closely how teachers overcome students' learning difficulties in Mathematics.

This is consistent with what happened at SDN Utama 2 Tarakan, SDIT Ulul Albab Tarakan, SDN 006 Sebatik Tengah and SDN 002 Malinau Kota. Based on interviews with the teachers, it obtained that many students felt difficulties in learning Mathematics. The four teachers stated that students were unable to solve mathematical problems because they did not understand the concept of the material and were not able in carrying out the calculations correctly. This makes it difficult for students to solve mathematical problems and finally students have a negative response to Mathematics. Thus, the teacher must be aware of the difficulties faced by students in the learning process, especially in Mathematics, because this is an important first step for teachers to design and manage Mathematics learning (Wijaya, Heuvel-panhuizen, & Doorman, 2014; Wijaya et al., 2019).

Based on the problems explained above, the focus to be examined in this study is how the

diagnosis carried out by the teacher to find out the students' learning difficulties in Mathematics and effective ways to overcome the learning difficulties in Mathematics. This study is limited to the area of North Borneo Province, Indonesia. There are 4 aspects to be analyzed in this study, including students' learning difficulties, teachers' practices in connection with diagnosing students' learning difficulties, teachers' actions in response to the results of the diagnosis, and parties involved regarding students' learning difficulties. The results of this study are expected to be able to contribute to elementary school teachers in overcoming students' learning difficulties, especially in Mathematics.

METHODS

The method used was qualitative research. This type of research is a phenomenology that will describe the way teachers diagnosing and overcoming elementary school students' learning difficulties in Mathematics. The data collection techniques used were questionnaires and interviews. Initially, the questionnaire was provided to the teachers via Google form to find out the effectiveness of the teachers' way of overcoming with students' learning difficulties in Mathematics. Then, the researchers conducted interviews with the teachers who mentioned that the methods used had been effective in overcoming students' learning difficulties in Mathematics. The interviews were conducted to find out more about the effectiveness of the way the teachers used in diagnosing and overcoming them. Semi-structured interviews were chosen so that the subject (the teachers) was able to describe personal information in more detail (Creswell, 2012). A telephone call interview was conducted by the researcher because of the distance between the researcher and teachers in North Borneo.

The subjects used in this study were 13 elementary school teachers in North Borneo taken by purposive sampling. The aspects used were adapted from a study by Wijaya et al. (2019) with 4 aspects, including the teachers' perception of students' learning difficulties, teachers' practices in connection with diagnosing students' learning difficulties, teachers' actions in response to the results of diagnosis and parties involved regarding students' learning difficulties.

The data analysis techniques in this study follow Miles, Huberman, & Saldana (2014) which include data condensation, data display and conclusion drawing. At the data condensation stage, the researcher chose, focused, simplified the data obtained through interviews with teachers (Miles et al., 2014). Then, the researcher made a descriptive presentation of the data (Ary, Jacobs, Sorensen, & Razavieh, 2010) and drew conclusions to obtain new findings based on research results obtained. The data validity technique in this study used triangulation. The triangulation used was source triangulation, in which in triangulation sources, the researcher collected data from more than 1 source to get support for the data obtained using the same method, which was interviews (Miles et al., 2014).

RESULTS AND DISCUSSION

This study obtained the results of a questionnaire and in-depth interviews with elementary school teachers in North Borneo. The researcher provided questionnaires to 13 elementary school teachers in North Borneo to determine how to diagnose students' learning difficulties in Mathematics and how to effectively overcome them. Of the 13 classroom teachers, it is known that there were only half the teachers who claimed that the method used was effective in solving students' learning difficulties in Mathematics (see Figure 1).

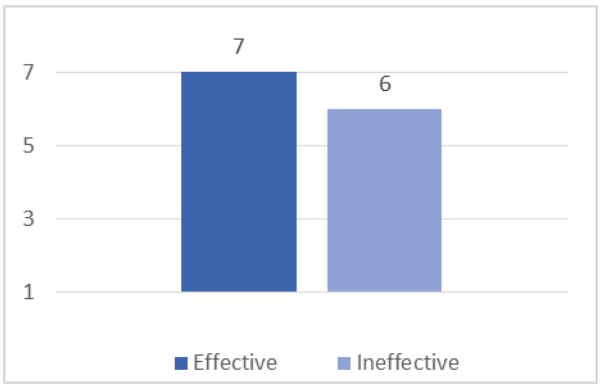

Figure 1. The effectiveness of the way the teachers overcome learning difficulties in mathematics

In-depth interviews were then conducted with 7 teachers who have used effective ways to overcome students' learning difficulties to find out more about how the process of diagnosing and overcoming students' learning difficulties in Mathematics. Among them were teachers from SDN 002 Malinau Kota, SD Integral Ar-Rabbani Tarakan, SDN 017 Tarakan, SDN 009 Tarakan, SDN 023 Tarakan, SDN 006 Tanjung Palas Tengah, and SDN 028 Tarakan. While the remaining 6 other teachers have not found the right way to overcome students' learning difficulties in Mathematics.

There are 6 ways the teachers carried out to overcome learning difficulties in Mathematics, including conducting remedial, giving additional assignments, increasing learning hours, providing individual tutoring, consulting with students' parents, and involving students in learning by asking them to solve problems on the board with teachers' direction. Among the 6 methods, 4 of them are effective in overcoming students' learning difficulties in Mathematics, including conducting remedial, increasing learning hours, providing individual tutoring, and involving students in learning. While giving additional assignments and consulting with students' parents has not given effectiveness in overcoming students' learning difficulties in Mathematics.

Students' Learning Difficulties

The teachers stated that there were indeed many students who still experienced difficulties in Mathematics. Learning difficulties in Mathematics has even become a national problem in many countries (Gersten et al., 2005). Based on the data obtained, there are two factors that become reasons

for students to have learning difficulties in Mathematics, including mathematical and non-mathematical factors.

The mathematical factors that cause students to experience learning difficulties are students' lack of understanding of the material concept taught by the teachers, the difficulty of students in carrying out multiplication, the difficulty in using material formulas, and students are less able to analyze word problems. While the non-mathematical factors cause students to have learning difficulties in Mathematics, including that the students lack to focus, tend not to like Mathematics, consider Mathematics difficult without trying, embarrassed to ask questions, lack of practice, are easy to despair, have poor study habits, and too much play cellphone. This is in line with a study by Wijaya et al. (2019) which stated that non-mathematical factors of difficulties experienced by students include lack of motivation, carelessness and ignorance.

However, there is one teacher who stated that students' learning difficulties may be influenced by how the teacher teaches and the teachers' lack of creativity in delivering the material. Thereby, it is important for teachers to acknowledge the difficulties and sources of difficulties experienced by students, so that the teachers are able to design plans to overcome them (Wijaya et al., 2014, 2019). While the material that is most difficult for students to understand is multiplication material. A percentage of 46.2% of teachers stated that the most difficult material for students was multiplication and fraction. While other materials that are difficult for students to understand is the materials of scale, division, use of formulas (volume, area, circumference), greatest common divisor (GCD), and least common multiple (LCM).

Teachers' Practice in connection with Diagnosing Students' Learning Difficulties

Regarding the teachers' practice in diagnosing students' learning difficulties in Mathematics, there are three ways in which teachers make a diagnosis, consisting of tests, observation and interviews. Based on the results of the questionnaire, 76.9% of teachers stated that they made a diagnosis of students' learning difficulties Mathematics while 23.1% of teachers had not made a diagnosis of learning difficulties in Mathematics experienced by students.

Of the three methods used by teachers, around 61.5% of teachers conducted tests to diagnose, 76.9% also chose observation to diagnose and 30.8% of teachers also used interviews in diagnosing students' learning difficulties in Mathematics. Meanwhile, only 2 teachers chose the three methods for diagnosis (see Table 1).

Table 1. Ways to diagnose students' learning difficulties in mathematics

No.	Name	How to Diagnose		
		Test	Observation	Interview
1	WHN	-	√	-
2	SA	-	√	-
3	MAI	√	√	√
4	MM	√	√	-
5	YTO	√	√	√
6	RR	√	-	-
7	HN	-	√	√
8	TC	√	-	-
9	ED	√	√	-
10	SDA	-	√	√
11	RRM	√	√	-
12	AA	√	-	-
13	ER	-	√	-

Based on table 1 above, it can be seen that there are 3 teachers who only use tests to diagnose, 3 teachers only conduct observations, 3 teachers conduct tests and observations, 2 teachers conduct observations and interviews and only 2 teachers use all the three methods, consisting of tests, observations and interviews. Thus, it can be concluded that most teachers make a diagnosis of students' learning difficulties in Mathematics by observation and the least way to use is interviews. Teachers who use observation usually see how students solve given problems, whether they are able to solve them or not. By conducting tests, the teachers can know with certainty whether students have understood the presented material or not. Then, students who are unable to complete the test questions correctly will be given a follow-up. Interviews were only conducted by 4 teachers to overcome learning difficulties in Mathematics.

This is in contrast to some studies which suggest using interviews to diagnose learning difficulties in Mathematics (Gervasoni, 2005; Mulligan, 2011; Tall & Razali, 1993; van Steenbrugge et al., 2010; Wright, 2003). This is because through interviews, the teacher will obtain detailed information related to students' difficulties in understanding Mathematics. The teacher can follow students' thoughts by asking questions as they solve mathematical problems and then asking them to express every thought that arises in students' minds when solving mathematical problems (Tall & Razali, 1993). It does not mean that tests and observations are not the right way to diagnose students' learning difficulties. However, to find out more about the causes of students' learning difficulties, it can be done through interviews with students concerned. It can be seen in a study by Mulligan (2011;

2010) which used three ways to overcome students' learning difficulties in Mathematics, including classroom observation, interview-based assessment and standardized assessment (tests).

About 69.2% of teachers stated that they made a diagnosis every time they did Mathematics learning while the remaining 30.8% made a diagnosis after taking exams, such as a midterm or final exam. The results of the diagnosis made by the teacher on the difficulties in Mathematics experienced by students include difficult to solve the problems given by the teacher because they do not understand the material concept, do not master carrying out multiplication and division calculations yet, have difficulties to understand the word problems, and have difficulties to interpret symbols in Mathematics. While other factors are factors in students who think that Mathematics is a difficult subject so students dislike Mathematics, are not focused when the teacher explains the material, are lazy to carry out calculations, are easily discouraged when unable to solve problems, lack of practice and embarrassed to ask questions when there is understood material.

However, after conducting in-depth interviews with the teachers, it was found that not all teachers actually made a diagnosis of students' learning difficulties in Mathematics. What the teachers are doing is actually evaluating the results of Mathematics learning rather than making a diagnosis. Besides, there are a few teachers who already understand the difference between diagnosing and evaluating. This is also in line with the results of a study by Wijaya et al. (2019) which stated that most teachers do not yet know the difference between making a diagnosis and evaluating learning.

Teachers' Actions in response to the Results of the Diagnosis

This finding can provide information that whether the teachers make a diagnosis of learning difficulties in Mathematics as the teachers' attempt to overcome students' learning difficulties and whether the teachers have done effective teaching or not. Actions taken by the teachers in response to the results of diagnosis of students' learning difficulties in Mathematics consist of several ways including making conducting remedial, increasing learning hours, providing individual tutoring, and involving students in learning.

Remedial is conducted by the teachers when students have difficulty solving the problems given, both in the form of word problems or others. Based on the questionnaire provided to 13 classroom teachers, 7 teachers stated that the method they used was effective in overcoming students' learning difficulties in Mathematics, while the remaining 6 stated that it had not been effective. As a matter of fact, the way the teachers do it is almost the same, which is through remedial. The remedial conducted by some teachers is apparently effective in overcoming students' learning difficulties in Mathematics. This is supported by several studies which stated that remedial is able to overcome students' learning difficulties in Mathematics (Chen, 2011; Hafid, Kartono, & Suhito, 2016; Karibasappa et al., 2008; Yang, Lai, Yao, & Huang, 2014). This happens due to the different ways of teaching and the ability of teachers to teach Mathematics material. Teachers who stated that the

method used has been effective can be seen from an increase in students' understanding and the score obtained by students increases compared to that before taking action. While the ineffective way of the teachers is still not able to improve students' understanding and students' score than before.

Provision of remedial can be carried out by creating learning that builds connections between students' formal and informal Mathematical knowledge, using appropriate representations depending on the context of the given problems (Yetkin, 2003) and it should focus more on students' conceptual understanding combined with procedural exercises (Moser et al., 2017; Yetkin, 2003). Since fundamental prerequisites consisting of conceptual and procedural knowledge are required to know the principles of Mathematics (Gersten et al., 2005; Mulligan, 2011), students must know not only what procedures are used, but also are able to carry out these procedures and why they carry out these procedures (Salihu & Räsänen, 2018). In fact, most teachers are more concerned with students' procedural knowledge rather than conceptual knowledge, so students find it difficult to understand Mathematical material and are unable to solve the given problems. This is also strengthened by giving exercises of similar problems without explaining the concept of the material.

In addition, some teachers choose to give additional assignments or exercises with similar problems to students who have learning difficulties in Mathematics with the aim that the students are able to understand the material presented. However, the provision of practice problems is given during class learning with supervision and guidance from the teacher. When the teacher has given such treatment, but there is no change in the understanding or score of students, some teachers choose to provide further improvement by providing individual tutoring. Individual tutoring is provided to students by adding learning hours outside of class hours. The teachers usually provide additional learning hour before class hour starts, during break time or after school with 30 minutes - 1 hour.

The teachers provide tutoring and increase learning hours by explaining material that is still difficult for students to understand using the same teaching way and methods. However, there were 2 teachers who stated that before giving improvements, they tried to find different solutions or methods to explain the material that was difficult for students to understand. This is consistent with previous studies which stated that to overcome the students' learning difficulties in Mathematics, teachers must be able to recognize the difficulties and sources of difficulties experienced by students. Afterwards, they should design a plan or instructions to overcome them (Wijaya et al., 2014, 2019; Yetkin, 2003).

Finally, involving students in learning. This is carried out by the teacher when students do not have confidence in learning Mathematics. The teacher asks students who have learning difficulties in Mathematics to solve the given questions on the blackboard with the teacher's direction and guidance. This is done by the teacher to motivate students to have confidence in solving mathematical problems. In addition, the teacher can also guide individually and see if the students have difficulty in solving the problem.

Besides the four ways above, there is one statement by the teachers that might be applied in overcoming students' learning difficulties in Mathematics, which is by involving parents in

overcoming them. Some teachers involve students' parents and give advice to parents to join in supervising and guiding the students to study at home and giving private tutoring to the students to help overcome students' learning difficulties in Mathematics.

Parties involved regarding Students' Learning Difficulties

Learning difficulties in Mathematics experienced by students certainly have involvement with various parties. The teachers explained that there were three parties involved to overcome the students' learning difficulties in Mathematics, consisting of parents, headmasters and teachers. A number of 8 teachers mentioned that parents had the most involvement in overcoming student learning difficulties. The teachers mentioned that parents have a role in guiding and supervising their children when studying at home. Additionally, parents can also provide facilities for children to learn, such as providing additional lessons with parents or private tutoring. This is in line with a study by Harackiewicz, Rozek, Hulleman, & Hyde (2012) which stated that parents can hold beliefs and engage in behavior that can shape the values and academic motivation of their children.

The second is the headmaster, in which the teachers can provide reports on students' learning difficulties and can provide input or advice to the headmaster to hold activities or solutions to overcome students' learning difficulties. Most teachers believe that the headmaster supports the teachers by adding class hours for students who need more lessons. This is in line with a study by Wijaya et al. (2019) which stated that the headmaster has a role in taking action to overcome and prevent students' learning difficulties by establishing school programs, such as additional learning hours at school. Therefore, the aspirations of the teachers as the instructor of learning get support from the headmaster as the party who regulates school policy.

The third is the teacher, in which the teacher as the designer of learning in the classroom is an important factor in diagnosing and overcoming students' difficulties. The teachers stated that they usually have discussions or share experiences related to the difficulties encountered while providing learning. The goal is to exchange ideas to find solutions to problems encountered during learning. This is carried out as an effort by the teachers to overcome students' learning difficulties. Furthermore, teachers must be able to realize the difficulties and sources of difficulties experienced by students, then design plans and instructions to overcome them (Wijaya et al., 2014, 2019; Yetkin, 2003). Moreover, the teachers' attitude towards Mathematics is also considered as an important influence on the Mathematics attitudes of students. Teachers with low self-concepts will be more likely to use traditional approaches in teaching and have less interest in trying new teaching strategies in Mathematics (Gunderson, Ramirez, Levine, & Beilock, 2012). Thereby, the teacher has an important role in students' learning ain Mathematics and helps students overcome learning difficulties in Mathematical.

CONCLUSION

This study concludes that to overcome students' learning difficulties in Mathematics, there are many ways teachers can carry out. Before knowing what steps will be taken to overcome them, the teachers should first make a diagnosis of the difficulties experienced by students. Diagnosing difficulties can be carried out in three ways, including tests, observation and interviews. Then, once the teacher obtains the diagnosis results, they can determine or design what steps can be used to overcome students' difficulties. The methods used by teachers to overcome the learning difficulties in Mathematics and have been effectively done are remedial, individual tutoring, providing additional learning hours, and involving students in learning. The most important thing is in teaching Mathematics material, teachers must put more emphasis on both conceptual understanding and procedural skills, not only procedural skills

Weaknesses in this study are the number of subjects studied that are still lacking and is still in a small scope so that the information obtained is still not satisfactory. In addition, this study only obtained information through questionnaires and interviews because of distances so that future research is expected to be able to use a variety of other data collection methods to ensure more accurate data obtained, such as observation and documentation. The benefits of this study are expected to be able to provide further information about the importance of diagnosing and overcoming students' learning difficulties in Mathematics to teachers, especially elementary school teachers.

The current research focuses more on the learning difficulties in Mathematics seen from the side of students when solving mathematical problems on a particular material while research from the side of teachers can be said to be still small. Therefore, there is a need for additional research to study teachers' knowledge of students' learning difficulties in Mathematics and what solutions might be offered to overcome them.

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